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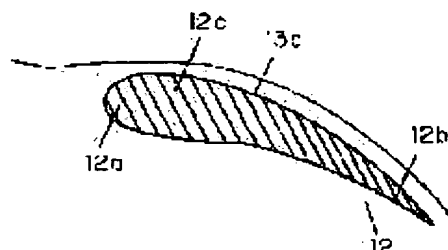
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## (54) BLOWER IN AIR CONDITIONER ETC.

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To suppress both blowing noises from a blower and fluid noises generated from a fan guard in a blower adopted to an air conditioner or the like by suppressing large peel-off of air flow at a negative pressure surface of a vane, and also suppressing a speed increase of a discharged air flow.

**SOLUTION:** A sectional shape of a vane 12 at its same diameter cylindrical section on the hub side 12c is rounded on the side of a front edge 12a to form a wing-like shape. A sectional area of the vane 12 at its same diameter cylindrical section on the outer peripheral side is evenly thin. It is thus possible to prevent large peel-off of air inflow from the front edge 12a, and increase of discharged air velocity from a discharge side 12b of the vane 12. It is also possible to suppress turbulence of discharged air flow when it passes a linear member of a fan guard. It is possible to suppress both blowing noises due to peel-off on the negative pressure surface side of the vane 12 and fluid noises generated from the fan guard.



## LEGAL STATUS

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**CLAIMS**

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[Claim(s)]

[Claim 1] Blowers, such as a motor, a hub attached in said motor, an impeller which consists of two or more wings prepared in the perimeter of said hub, an orifice surrounding the periphery of said impeller, and an air conditioner which consisted of fan guards prepared in the discharge side, made the profile the blade-section configuration by the side of the hub of said wing, and made the blade-section configuration by the side of the periphery of said wing plate-like [ of thin meat ], or the shape of a profile of thin meat.

[Claim 2] Blowers, such as an air conditioner according to claim 1 which prepared the dimple of two or more abbreviation semi-sphere configurations in the suction-surface side by the side of the periphery of a wing.

[Claim 3] Blowers, such as an air conditioner according to claim 1 which prepared two or more Librettos in the suction-surface side by the side of the periphery of a wing.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the blower used for the air conditioner currently used in the field broad from home use to business use.

[0002]

[Description of the Prior Art] In recent years, the exterior unit of an air conditioner is in the

inclination for it to be installed in various locations and for silence of the air blasting noise to be desired more, with diversification of a building situation.

[0003] There are some which are shown in JP,5-321982,A as a blower used for the exterior unit of the conventional air conditioner etc.

[0004] Hereafter, the axial flow mold blower used for the exterior unit of the conventional air conditioner mentioned above is explained, referring to a drawing.

[0005] Drawing 13 - drawing 16 show the structure of the exterior unit of the conventional air conditioner, and a blower.

[0006] In drawing 13 - drawing 16, 1 is the body of the exterior unit of an air conditioner, 2 is a box, 3 is the heat exchanger prepared in the box 2, 4 is the compressor formed in the box 2, 5 is the blower of the axial flow mold formed in the reverse field the air-drawing side of the heat exchanger 3 in a box 2, and 6 is the fan guard prepared in the discharge side of the axial flow mold blower 5.

[0007] 7 is the motor of an axial blower 5, 8 is the impeller which arranged two or more wings 10 in the perimeter of installation and hub 8a for hub 8a at the motor 7, and 9 is an orifice surrounding the perimeter of an impeller 7.

[0008] Two or more wings 10 are profiles to which it applies to 10d a periphery side from hub side 10c, and the cross-section configuration of the wing 10 in the cylinder cross-section development view ( drawing 15 R> 5, drawing 16 ) of the same radius has a radius of circle in wing 10 first-transition 10a.

[0009] The actuation is explained below about the exterior unit of the air conditioner constituted as mentioned above, and a blower.

[0010] First, in case the air inhaled from the air-drawing side of a heat exchanger 3 passes a heat exchanger 3, from a compressor 4, heat exchange of it is carried out to the refrigerant sent to the heat exchanger 3, and it carries out a temperature change. The air which carried out the temperature change is that a motor 7 rotates an impeller 8 to a predetermined hand of cut, is inhaled by the blower 5 of the axial flow mold formed in the field of objection by the side of air drawing of the heat exchanger 3 of a box 2, and blows off from a blower 5 out of a box 2 through the fan guard 6.

[0011] Here, in case a heat exchanger 3 is passed, an inflow air current [ as opposed to / turbulence and since an impeller 8 absorbs as it is / first transition 10a of a wing 10 in the flow of air ] serves as instability. However, since the wing 10 forms in first transition 10a the profile which has a radius of circle, even if the fluid inlet angle of an inflow air current and the inlet angle of first transition are not in agreement in first transition 10a, big exfoliation is not caused by suction-surface side 11 of first transition 10a, but promotion is suppressed for the exfoliation from first transition 10a by suction-surface side 11 of a wing 10, the increment in turbulence is suppressed, and degradation of the air blasting engine performance of a blower 5 and the increment in the noise are suppressed.

[0012]

[Problem(s) to be Solved by the Invention] In the blower used for the exterior units of this air conditioner In the wing 10 of an impeller 8, an internal air current to 10d a periphery side according to the centrifugal force by revolution A bias, It becomes inflow flow unstable to the pan whose fluid inlet angle is not stable in hub side 10c. Although the effectiveness of the profile which has a radius of circle in first transition 10a of a wing 10 is demonstrated more and exfoliation by suction-surface side 11c of a wing 10 is suppressed when the fluid inlet angle of the inflow air current in first transition 10a in hub side 10c becomes smaller than the design inlet angle of first transition 10a Since it becomes the inflow flow which inflow air currents gathered by 10d the periphery side of a wing 10, and was stabilized mostly Since the fluid inlet angle of the inflow air current in first transition 10a and the design inlet angle of first transition 10a do not change greatly by 10d a periphery side with optimization of a 10d inlet blade angle a periphery side, The exfoliation improvement effect of a profile is small, and an operation of a profile accelerates the about 11d rate of flow the suction-surface side of a wing 10 (accelerating to homogeneity thin meat), and it is breathed out out of an impeller 8 from discharge-side 10b of a wing 10.

[0013] The periphery side of a wing 10 from the first however, in 10d The kinetic energy which an internal air current gives to 10d according to the centrifugal force by revolution, and it gives to an air current by the wing 10 a periphery side since peripheral speed is still quicker, a bias and greatly A sake, In case a regurgitation air current passes the fan guard's 6 wire rod quickly (not shown) substantially compared with hub side 10c, the fluid noise generates the rate of flow of the air current which carries out the regurgitation from a wing 10 from the fan guard 6 of the back wash whose turbulence of a regurgitation air current is 10d the periphery side of a wing 10 greatly.

[0014] Turbulence of the regurgitation air current at the time of accelerating further the regurgitation air current of discharge-side 10b of a wing 10, when it accelerates the about 11d rate of flow the suction-surface side of a wing 10 in 10d, since the cross-section configuration of a wing 10 is a profile, and a regurgitation air current passing the fan guard's 6 wire rod becomes still larger the periphery side of this to the wing 10, and the fluid noise from the fan guard 6 of 10d back wash increases the periphery side of a wing 10.

[0015] Therefore, although the increment in the air blasting noise independent [ blower 5 ] is suppressed by profile-izing the wing 10 of an impeller 8, the fluid noise from the fan guard 6 increases, and the noise increases to reverse as an exterior unit 1 of an air conditioner.

Therefore, in blowers, such as an air conditioner, while suppressing the big exfoliation by the side of a wing suction surface and suppressing the increment in the air blasting noise of a blower, it is required that the increment in the fluid noise generated from a fan guard should also be suppressed.

[0016] In blowers, such as an air conditioner, this invention aims at suppressing accelerating of a regurgitation air current and suppressing both increments in the fluid noise generated from the increment and fan guard of the air blasting noise of a blower while it prevents big exfoliation in a wing suction surface.

[0017]

[Means for Solving the Problem] By this invention's making a profile the blade-section configuration by the side of the hub of the wing of an impeller, and making the blade-section configuration by the side of the periphery of a wing into plate-like [ of thin meat ], or the shape of a profile of thin meat, in order to solve this technical problem As opposed to the unstable inflow flow by which a fluid inlet angle is not stabilized at a hub side because an internal air current inclines toward a periphery side according to the centrifugal force by revolution The effect to which the regurgitation flow which the effectiveness of the profile which has a radius of circle in a blade leading edge was demonstrated more, and suppressed the big exfoliation by the side of the suction surface of a wing, and the profile accelerated by the suction-surface side since peripheral speed was also small makes turbulence increase with a fan guard also becomes small far compared with a periphery side.

[0018] Moreover, since it becomes the inflow flow which inflow air currents gathered for the wing periphery side, and was stabilized mostly Since the fluid inlet angle of the inflow air current in periphery side first transition and the design inlet angle of first transition do not change greatly with optimization of an inlet blade angle, Since flow does not exfoliate greatly in the blade-section configuration of plate-like [ of thin meat ], or the shape of a profile of thin meat and it does not accelerate the rate of flow by the side of wing suction-surface close attendants, it does not accelerate the regurgitation air current of a wing discharge side, and turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod does not become large. Therefore, the outdoor blower of the air conditioner which suppresses both increments in the fluid noise generated from the increment and fan guard of the air blasting noise by the big exfoliation by the side of the wing suction surface of a blower is obtained.

[0019]

[Embodiment of the Invention] The hub where invention of this invention according to claim 1 was attached in the motor and said motor, The impeller which consists of two or more wings prepared in the perimeter of said hub, and the orifice surrounding the periphery of said impeller, Consist of fan guards prepared in the discharge side, and the blade-section configuration by the side of the hub of said wing is made into a profile. Because make the blade-section configuration

by the side of the periphery of said wing into plate-like [ of thin meat ], or the shape of a profile of thin meat and an internal air current inclines toward a periphery side according to the centrifugal force by revolution. The effectiveness of the profile which has a radius of circle in a blade leading edge is demonstrated more to the unstable inflow flow by which a fluid inlet angle is not stabilized in a hub side, and the big exfoliation by the side of the suction surface of a wing is suppressed. Moreover, since peripheral speed is also small, the effect to which turbulence is made to increase with a fan guard also has the far small regurgitation flow which the profile accelerated by the suction-surface side compared with a periphery side.

[0020] Moreover, since it becomes the inflow flow which inflow air currents gathered in the wing periphery side, and was stabilized mostly. Since the fluid inlet angle of the inflow air current in periphery side first transition and the design inlet angle of first transition do not change greatly with optimization of an inlet blade angle, since flow does not exfoliate greatly in the blade-section configuration of plate-like [ of thin meat ], or the shape of a profile of thin meat and it does not accelerate the rate of flow by the side of wing suction-surface close attendants, it does not accelerate the regurgitation air current of a wing discharge side, and turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod does not become large. Therefore, it has an operation of suppressing both increments in the fluid noise generated from the increment and fan guard of the air blasting noise by the big exfoliation by the side of the wing suction surface of a blower.

[0021] Since invention according to claim 2 serves as inflow flow which was blowers, such as an air conditioner according to claim 1 which prepared the dimple of two or more abbreviation semi-sphere configurations in the suction-surface side of the wing by the side of a periphery, and inflow air currents gathered for the wing periphery side, and was stabilized mostly, since the fluid inlet angle of the inflow air current in periphery side first transition and the design inlet angle of first transition do not change greatly with optimization of an inlet blade angle. The flow separation from a suction-surface side front face is enough controlled by operation of the dimple which prepared the wing suction-surface side also in the blade-section configuration of plate-like [ of thin meat ], or the shape of a profile of thin meat. Turbulence of flow is suppressed, and since the rate of flow by the side of the suction-surface close attendants by the side of a wing periphery is not accelerated like a profile configuration, either, the rate of flow of a wing regurgitation air current does not increase, either.

[0022] Therefore, turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod is reduced. Therefore, while controlling the increment in the air blasting noise by the exfoliation by the side of the wing suction surface of a blower, it has an operation that the fluid noise generated from a fan guard decreases.

[0023] Since invention according to claim 3 serves as inflow flow which was blowers, such as an air conditioner according to claim 1 which prepared Libretto in the suction-surface side of the wing by the side of a periphery, and inflow air currents gathered for the wing periphery side, and was stabilized mostly. The fluid inlet angle of the inflow air current in periphery side first transition and the design inlet angle of first transition do not change greatly with optimization of an inlet blade angle. Exfoliation of flow is controlled by the suction-surface side of first transition also in the blade-section configuration of plate-like [ of thin meat ], or the shape of a profile of thin meat. Furthermore, the turbulent sublayer by the side of wing suction-surface close attendants piles up a periphery side according to the centrifugal force of a revolution of an impeller, and a turbulent sublayer does not accelerate according to frictional resistance buildup, but turbulence is also suppressed by Libretto prepared in the suction surface by the side of a wing periphery.

[0024] Therefore, turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod is reduced. Therefore, while controlling the increment in the basing-on exfoliation [ by the side of the wing suction surface of a blower ], and development of turbulent sublayer air blasting noise, it has an operation that the fluid noise generated from a fan guard decreases.

[0025]

[Example] Hereafter, the example of this invention is explained using drawing 1 - drawing 12 .

[0026] In addition, in order to avoid duplication about the part of the same configuration as the conventional example, the same sign is attached and explanation is omitted.

[0027] (Example 1) Drawing 1 – drawing 5 show blowers, such as an air conditioner of the example of this invention. They are two or more wings by which 12 was prepared in the perimeter of hub 8a of an impeller 8 in drawing 1 – drawing 5. It is the profile to which the cross-section configuration of the wing 12 in the cylinder cross section of the same radius of hub side 12c has a radius of circle in wing 12 first-transition 12a. The cross-section configuration of the wing 12 in a cylinder cross section with a same radius of 12d is tabular [ of thin meat ] a periphery side. A periphery side from hub side 12c change of the cross-section configuration of the 12d wing 12 If it applies in the radial center of abbreviation from hub side 12c, and thickness of a profile is gradually made thin and it applies to 12d a periphery side from the radial center of abbreviation, it is plate-like [ of the thick thin meat of abbreviation homogeneity ].

[0028] The air current of the impeller 8 interior to 12d a periphery side according to the centrifugal force according to a revolution of an impeller 8 by this configuration A bias, The effectiveness of the profile which has a radius of circle in first transition 12a of a wing 12 is demonstrated more to the unstable inflow flow by which a fluid inlet angle is not stabilized in hub side 12c, and as drawing 4 shows, the big exfoliation by suction-surface side 13c of a wing is suppressed. Moreover, since peripheral speed is also small, The effect to which turbulence is made to increase with the fan guard 6 also has the far small regurgitation flow which the profile accelerated by suction-surface side 13c compared with 12d a periphery side.

[0029] Moreover, since it becomes the inflow flow which inflow air currents gathered by 12d the periphery side of a wing 12, and was stabilized mostly as drawing 5 shows Since the fluid inlet angle of the inflow air current in 12d first transition 12a and the design inlet angle of first transition 12a do not change greatly a periphery side with optimization of the inlet angle of a wing 12, Since flow does not exfoliate greatly by optimization of a design in the plate configuration of 12d thin meat the periphery side of a wing 12 and it does not accelerate the about 13d rate of flow the suction-surface side of a wing 12 It does not accelerate the regurgitation air current of discharge-side 12b of a wing 12, and turbulence of the regurgitation air current at the time of a regurgitation air current passing the fan guard's 6 wire rod does not become large.

[0030] Therefore, both increments in the fluid noise generated from the increment and the fan guard 6 of the air blasting noise by suction-surface side of wing 12 of blower 5 13c and the big exfoliation by 13d are suppressed.

[0031] (Example 2) Drawing 6 – drawing 8 show blowers, such as an air conditioner of the example 2 of this invention. In addition, in order to avoid duplication about the part of the same configuration as an example 1, the same sign is attached and explanation is omitted.

[0032] 14 is the dimple of two or more abbreviation semi-sphere configurations prepared in 13d the 12d suction-surface side the periphery side from the radial center of abbreviation of a wing 12.

[0033] Since it becomes the inflow flow which inflow air currents gathered for 12d the periphery side of a wing 12, and was mostly stabilized by this configuration as drawing 8 showed The fluid inlet angle of the inflow air current in 12d first transition 12a and the design inlet angle of first transition 12a do not change greatly the periphery side of a wing 12 with optimization of the inlet angle of a wing 12. Since the flow separation from a 13d front face is controlled by operation of two or more dimples 14 a suction-surface side in 13d the suction-surface side of a wing 12 also in the plate configuration of the thin meat of 12d of peripheries of a wing 12 Since turbulence of flow is suppressed and the about 13d rate of flow is not accelerated the suction-surface side of a wing 12 like [ in the case of the cross-section configuration of the profile of a wing 12 ], either, the rate of flow of a 12d regurgitation air current does not increase the periphery side of a wing 12, either.

[0034] Therefore, turbulence of the regurgitation air current at the time of a regurgitation air current passing the fan guard's 6 wire rod is reduced. Therefore, control of the increment in the air blasting noise by suction-surface sides [ of the wing 12 of a blower 5 / 13c and 13d ]

exfoliation reduces the fluid noise generated from the fan guard 6.

[0035] (Example 3) Drawing 9 – drawing 12 show blowers, such as an air conditioner of the example 3 of this invention. In addition, in order to avoid duplication about the part of the same configuration as an example 1, the same sign is attached and explanation is omitted.

[0036] 15 is two or more Librettos (fluting to a hand of cut) prepared in 13d the 12d suction-surface side the periphery side from the radial center of abbreviation of a wing 12.

[0037] Since it becomes the inflow flow which inflow air currents gathered for 12d the periphery side of a wing 12, and was mostly stabilized by this configuration as drawing 12 showed The fluid inlet angle of the inflow air current in 12d first transition 12a and the design inlet angle of first transition 12a do not change greatly the periphery side of a wing 12 with optimization of the inlet angle of a wing 12. With Libretto 15 which exfoliation of flow was controlled by 13d the suction-surface side of first transition 12a, and was further prepared in 13d the suction-surface side also in the plate-like blade-section configuration of the thin meat of 12d of peripheries of a wing 12 Since it controls that an about 13d turbulent sublayer piles up 12d a periphery side the suction-surface side of the wing 12 by the centrifugal force of a revolution of an impeller 8, and a turbulent sublayer progresses according to buildup of frictional resistance The regurgitation air current from discharge-side 12b of a wing 12 does not accelerate like [ in case a wing 12 is a profile configuration ], but turbulence is also suppressed.

[0038] Therefore, turbulence of the regurgitation air current at the time of a regurgitation air current passing the fan guard's 6 wire rod is reduced. Therefore, while controlling the increment in the air blasting noise by suction-surface sides [ of the wing 12 of a blower 5 / 13c and 13d ] exfoliation, and the increment in the air blasting noise according to development of a 13d turbulent sublayer a 12d suction-surface side the periphery side of a wing 12, the fluid noise generated from the fan guard 6 decreases.

[0039]

[Effect of the Invention] Since the air current inside an impeller inclines toward the periphery side of a wing according to the centrifugal force by revolution of an impeller as mentioned above according to this invention, The big exfoliation by the side of the suction surface of a wing is suppressed to the unstable inflow flow by which a fluid inlet angle is not stabilized in a hub side according to the effectiveness of the profile which has a radius of circle in a blade leading edge. Moreover, since peripheral speed is also small, The effect to which turbulence is made to increase with a fan guard also has the far small regurgitation flow by the side of the suction surface by profile-izing which accelerated compared with a periphery side.

[0040] Moreover, in a periphery side, since flow does not exfoliate greatly by optimization of an inlet blade angle in the blade-section configuration of plate-like [ of thin meat ], or the shape of a profile of thin meat since it becomes the inflow flow which inflow air currents gathered and was stabilized mostly, and it does not accelerate the rate of flow by the side of wing suction-surface close attendants, turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod does not become large.

[0041] Therefore, the advantageous effectiveness of suppressing both increments in the fluid noise generated from the increment and fan guard of the air blasting noise by the big exfoliation by the side of a wing suction surface is acquired.

[0042] Moreover, the flow separation from a suction-surface side front face is controlled by operation of a dimple by the wing suction-surface side at a periphery side also in the blade-section configuration of plate-like [ of thin meat ], or the shape of a profile of thin meat, turbulence of flow is suppressed, and since the rate of flow by the side of wing suction-surface close attendants is not accelerated like a profile configuration, either, turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod is reduced.

[0043] Therefore, while controlling the increment in the air blasting noise by the exfoliation by the side of a wing suction surface, the advantageous effectiveness that the fluid noise generated from a fan guard decreases is acquired.

[0044] Moreover, since exfoliation of flow is controlled by optimization of a design by the suction-surface side of first transition at a wing periphery side also in the blade-section

configuration of plate-like [ of thin meat ], or the shape of a profile of thin meat and it controls that a turbulent sublayer progresses further with Libretto prepared in the suction-surface side of the wing periphery section, turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod is reduced.

[0045] Therefore, while controlling the increment in the air blasting noise by the exfoliation by the side of a wing suction surface, and development of a turbulent sublayer, the advantageous effectiveness that the fluid noise generated from a fan guard decreases is acquired.

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**DESCRIPTION OF DRAWINGS**

[Brief Description of the Drawings]

[Drawing 1] The sectional view of blowers, such as an air conditioner in the example 1 of this invention

[Drawing 2] The front view of blowers, such as an air conditioner in the example 1 of this invention

[Drawing 3] The X-X sectional view of blowers, such as an air conditioner in the example 1 of this invention

[Drawing 4] The hub side (A-A) cylinder cross-section development view of blowers, such as an air conditioner in the example 1 of this invention

[Drawing 5] The periphery side (B-B) cylinder cross-section development view of blowers, such as an air conditioner in the example 1 of this invention

[Drawing 6] The front view of blowers, such as an air conditioner in the example 2 of this invention

[Drawing 7] The hub side (A-A) cylinder cross-section development view of blowers, such as an air conditioner in the example 2 of this invention

[Drawing 8] The periphery side (B-B) cylinder cross-section development view of blowers, such as an air conditioner in the example 2 of this invention

[Drawing 9] The front view of blowers, such as an air conditioner in the example 3 of this invention

[Drawing 10] The X-X sectional view of blowers, such as an air conditioner in the example 3 of this invention

[Drawing 11] The hub side (A-A) cylinder cross-section development view of blowers, such as an air conditioner in the example 3 of this invention

[Drawing 12] The periphery side (B-B) cylinder cross-section development view of blowers, such as an air conditioner in the example 3 of this invention

[Drawing 13] The sectional view of the exterior unit of the conventional air conditioner

[Drawing 14] The front view of the blower used for the exterior unit of the conventional air conditioner

[Drawing 15] The hub side (A-A) cylinder cross-section development view of the outdoor blower of the conventional air conditioner



[Drawing 16] The periphery side (B-B) cylinder cross-section development view of the outdoor blower of the conventional air conditioner

[Description of Notations]

- 5 Blower
- 6 Fan Guard
- 7 Motor
- 8 Impeller
- 8a Hub
- 9 Orifice
- 12 Wing
- 12c Hub side
- 12d Periphery side
- 13c, 13d Suction-surface side
- 14 Dimple
- 15 Libretto

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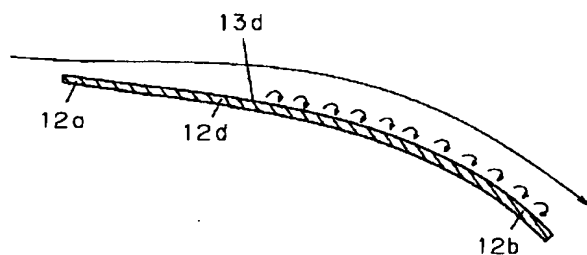
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## DRAWINGS

[Drawing 5]

12d 外周側  
13d 負圧面側



[Drawing 7]

(19)日本国特許庁 (J P)

(12) 公 開 特 許 公 報 (A)

(11)特許出願公開番号

特開平10-196590

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(71)出願人 000004488

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(54)【発明の名称】 空気調和機等の送風機

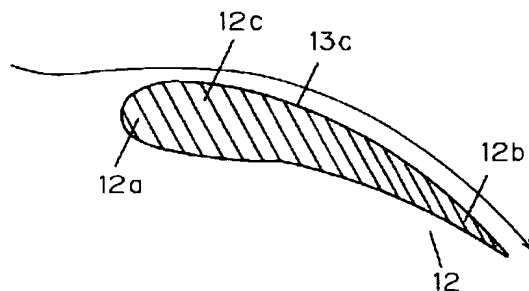
(57)【要約】

【課題】 空気調和機等に用いられる送風機において、羽根負圧面での大きな剥離を防ぐと共に、吐出気流の増速を抑え、送風機の送風騒音の増加とファンガードから発生する流体騒音の増加の両方を抑える。

【解決手段】 羽根12のハブ側12cの同一半径の円筒断面における羽根12の断面形状が羽根12前縁12aに丸みを持つ翼型とし、外周側の同一半径の円筒断面における羽根12の断面形状が均一薄肉とすることで、前縁12aで流入気流が大きく剥離せず、かつ、羽根12の吐出側12bからの吐出気流が増速されず、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが大きくなる。従って、羽根12の負圧面側での剥離による送風騒音の増加とファンガードから発生する流体騒音の増加の両方を抑える。

12c ハブ側

13c 負圧面側



## 【特許請求の範囲】

【請求項1】 モータと、前記モータに取り付けられたハブと、前記ハブの周囲に設けられた複数の羽根からなる羽根車と、前記羽根車の外周を囲むオリフィスと、吐出側に設けられたファンガードで構成され、前記羽根のハブ側の羽根断面形状を翼型とし、前記羽根の外周側の羽根断面形状を薄肉の平板状、あるいは薄肉の翼型にした空気調和機等の送風機。

【請求項2】 羽根の外周側の負圧面側に複数の略半球形状のディンプルを設けた請求項1記載の空気調和機等の送風機。

【請求項3】 羽根の外周側の負圧面側に複数のリブレットを設けた請求項1記載の空気調和機等の送風機。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、家庭用から業務用まで幅広い分野で使用されている空気調和機等に用いられる送風機に関するものである。

【0002】

【従来の技術】近年、建築事情の多様化に伴い、空気調和機の室外機は様々な場所に設置されるようになってきており、より送風騒音の静音化が望まれる傾向にある。

【0003】従来の空気調和機の室外機等に用いられる送風機としては、特開平5-321982号公報に示されているものがある。

【0004】以下、図面を参照しながら、上述した従来の空気調和機の室外機に用いられる軸流型送風機について説明する。

【0005】図13～図16は従来の空気調和機の室外機、及び送風機の構造を示すものである。

【0006】図13～図16において、1は空気調和機の室外機の本体であり、2は箱体であり、3は箱体2内に設けられた熱交換器であり、4は箱体2内に設けられた圧縮機であり、5は箱体2内の熱交換器3の空気吸込側と反対の面に設けられた軸流型の送風機であり、6は軸流型送風機5の吐出側に設けられたファンガードである。

【0007】7は軸流送風機5のモータであり、8はモータ7にハブ8aを取り付け、ハブ8aの周囲に複数の羽根10を配設した羽根車であり、9は羽根車7の周囲を囲むオリフィスである。

【0008】複数の羽根10は、ハブ側10cから外周側10dにかけて、同一半径の円筒断面展開図（図15、図16）における羽根10の断面形状が羽根10前縁10aに丸みを持つ翼型である。

【0009】以上のように構成された空気調和機の室外機、及び送風機について以下その動作を説明する。

【0010】まず、熱交換器3の空気吸込側より吸い込まれた空気は、熱交換器3を通過する際に圧縮機4より熱交換器3に送られた冷媒と熱交換し、温度変化する。

温度変化した空気はモータ7が羽根車8を所定の回転方向に回転することで、箱体2の熱交換器3の空気吸込側の反対の面に設けられた軸流型の送風機5に吸い込まれ、送風機5よりファンガード6を介して箱体2外へ吹き出される。

【0011】ここで、熱交換器3を通過する際、空気の流れが乱れ、そのまま、羽根車8に吸い込まれるため、羽根10の前縁10aに対する流入気流は不安定となる。しかし、羽根10が前縁10aに丸みを有する翼型を形成しているため、前縁10aにおいて流入気流の流入角と前縁の入口角が一致しなくても前縁10aの負圧面側11で大きな剥離を起こさず、羽根10の負圧面側11で前縁10aからの剥離が助長が抑えられ、乱れの増加が抑えられ、送風機5の送風性能の劣化と騒音の増加を抑える。

【0012】

【発明が解決しようとする課題】この空気調和機の室外機用に用いられた送風機では、羽根車8の羽根10において、回転による遠心力により内部の気流は外周側10dに偏り、ハブ側10cでは流入角が安定しないさらに不安定な流入流れとなり、ハブ側10cにおける前縁10aでの流入気流の流入角が前縁10aの設計入口角より小さくなった際に、羽根10の前縁10aに丸みを有する翼型の効果がより発揮され羽根10の負圧面側11cでの剥離を抑えるが、羽根10の外周側10dでは流入気流が集まりほぼ安定した流入流れとなるので、外周側10dの羽根入口角の最適化により外周側10dでは前縁10aでの流入気流の流入角と前縁10aの設計入口角が大きく異ならないため、翼型の剥離改善効果が小さくかつ翼型の作用により羽根10の負圧面側11d近傍の流速が増速され（均一薄肉に対する増速）、羽根10の吐出側10bから羽車8外へ吐出される。

【0013】しかし、元々、羽根10の外周側10dでは、回転による遠心力により内部の気流が外周側10dに偏り、さらに、周速が速いため羽根10によって気流に与える運動エネルギーが大きいため、羽根10から吐出する気流の流速はハブ側10cに比べ大幅に速く（図示せず）、吐出気流がファンガード6の線材を通過する際、吐出気流の乱れが大きく羽根10の外周側10dの後流のファンガード6から流体騒音が発生する。

【0014】このことから、羽根10の外周側10dでは、羽根10の断面形状が翼型であるため羽根10の負圧面側11d近傍の流速が増速されると羽根10の吐出側10bの吐出気流がさらに増速され、吐出気流がファンガード6の線材を通過する際の吐出気流の乱れがさらに大きくなり、羽根10の外周側10dの後流のファンガード6からの流体騒音が増加する。

【0015】よって、羽根車8の羽根10を翼型化することにより送風機5単独の送風騒音の増加は抑えられるが、ファンガード6からの流体騒音が増加し、空気調和

機の室外機1としては逆に騒音が増加する。従って、空気調和機等の送風機において、羽根負圧面側での大きな剥離を抑え送風機の送風騒音の増加を抑えると共に、ファンガードから発生する流体騒音の増加も抑えることが要求されている。

【0016】本発明は、空気調和機等の送風機において、羽根負圧面での大きな剥離を防ぐと共に、吐出気流の増速を抑え、送風機の送風騒音の増加とファンガードから発生する流体騒音の増加の両方を抑えることを目的とする。

【0017】

【課題を解決するための手段】この課題を解決するために、本発明は、羽根車の羽根のハブ側の羽根断面形状を翼型とし、羽根の外周側の羽根断面形状を薄肉の平板状、あるいは薄肉の翼型状にすることにより、回転による遠心力により内部の気流が外周側に偏ることで、ハブ側では流入角が安定しない不安定な流入流れに対し、羽根前縁に丸みを有する翼型の効果がより発揮され羽根の負圧面側での大きな剥離を抑え、また、周速も小さいため、翼型により負圧面側で増速された吐出流れがファンガードにて乱れを増加させる影響も外周側に比べ遥かに小さくなる。

【0018】また、羽根外周側に流入気流が集まりほぼ安定した流入流れとなるので、羽根入口角の最適化により外周側前縁での流入気流の流入角と前縁の設計入口角が大きく異ならないため、薄肉の平板状、あるいは薄肉の翼型状の羽根断面形状でも流れが大きく剥離せず、かつ、羽根負圧面側近傍の流速が増速されないで、羽根吐出側の吐出気流が増速されず、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが大きくなり、従って、送風機の羽根負圧面側での大きな剥離による送風騒音の増加とファンガードから発生する流体騒音の増加の両方を抑える空気調和機の室外送風機が得られる。

【0019】

【発明の実施の形態】本発明の請求項1記載の発明は、モータと、前記モータに取り付けられたハブと、前記ハブの周囲に設けられた複数の羽根からなる羽根車と、前記羽根車の外周を囲むオリフィスと、吐出側に設けられたファンガードで構成され、前記羽根のハブ側の羽根断面形状を翼型とし、前記羽根の外周側の羽根断面形状を薄肉の平板状、あるいは薄肉の翼型状にしたものであり、回転による遠心力により内部の気流が外周側に偏ることで、ハブ側では流入角が安定しない不安定な流入流れに対し、羽根前縁に丸みを有する翼型の効果がより発揮され、羽根の負圧面側での大きな剥離を抑え、また、周速も小さいため、翼型により負圧面側で増速された吐出流れがファンガードにて乱れを増加させる影響も外周側に比べ遥かに小さい。

【0020】また、羽根外周側では流入気流が集まりほ

ぼ安定した流入流れとなるので、羽根入口角の最適化により外周側前縁での流入気流の流入角と前縁の設計入口角が大きく異ならないため、薄肉の平板状、あるいは薄肉の翼型状の羽根断面形状でも流れが大きく剥離せず、かつ、羽根負圧面側近傍の流速が増速されないで、羽根吐出側の吐出気流が増速されず、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが大きくなり、従って、送風機の羽根負圧面側での大きな剥離による送風騒音の増加とファンガードから発生する流体騒音の増加の両方を抑えるという作用を有する。

【0021】請求項2記載の発明は、外周側の羽根の負圧面側に複数の略半球形状のディンプルを設けた請求項1記載の空気調和機等の送風機であり、羽根外周側に流入気流が集まりほぼ安定した流入流れとなるため、羽根入口角の最適化により外周側前縁での流入気流の流入角と前縁の設計入口角が大きく異ならないで、薄肉の平板状、あるいは薄肉の翼型状の羽根断面形状でも、羽根負圧面側を設けたディンプルの作用により負圧面側表面からの流れの剥離が十分抑制され、流れの乱れが抑えられ、かつ、羽根外周側の負圧面側近傍の流速も翼型形状のように増速しないので羽根吐出気流の流速も増加しない。

【0022】そのため、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが低減される。従って、送風機の羽根負圧面側での剥離による送風騒音の増加を抑制すると共に、ファンガードから発生する流体騒音が低減するという作用を有する。

【0023】請求項3記載の発明は、外周側の羽根の負圧面側に、リブレットを設けた請求項1記載の空気調和機等の送風機であり、羽根外周側に流入気流が集まりほぼ安定した流入流れとなるので、羽根入口角の最適化により外周側前縁での流入気流の流入角と前縁の設計入口角が大きく異ならず、薄肉の平板状、あるいは薄肉の翼型状の羽根断面形状でも、前縁の負圧面側で流れの剥離が抑制され、さらに、羽根外周側の負圧面に設けたリブレットにより羽根車の回転の遠心力により羽根負圧面側近傍の乱流境界層が外周側に集積し摩擦抵抗増大により乱流境界層が増速せず、乱れも抑えられる。

【0024】そのため、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが低減される。従って、送風機の羽根負圧面側での剥離及び乱流境界層の発達による送風騒音の増加を抑制すると共に、ファンガードから発生する流体騒音が低減するという作用を有する。

【0025】

【実施例】以下、本発明の実施例について図1～図12を用いて説明する。

【0026】尚、従来例と同一構成の部分については重複をさけるため、同一符号を付けて説明を省略する。

【0027】（実施例1）図1～図5は本発明の実施例の空気調和機等の送風機を示す。図1～図5において、

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12は、羽根車8のハブ8aの周囲に設けられた複数の羽根であり、ハブ側12cの同一半径の円筒断面における羽根12の断面形状が羽根12前縁12aに丸みを持つ翼型であり、外周側12dの同一半径の円筒断面における羽根12の断面形状が薄肉の板状であり、ハブ側12cから外周側12dへの羽根12の断面形状の変化は、ハブ側12cから半径方向の略中央にかけ漸次翼型の肉厚を薄くし、半径方向の略中央から外周側12dにかけては略均一の肉厚の薄肉の平板状である。

【0028】この構成により、羽根車8の回転による遠心力により羽根車8内部の気流が外周側12dに偏り、ハブ側12cでは流入角が安定しない不安定な流入流れに対し、羽根12の前縁12aに丸みを有する翼型の効果がより発揮され、図4で示すように羽根の負圧面側13cでの大きな剥離を抑え、また、周速も小さいため、翼型により負圧面側13cで増速された吐出流れがファンガード6にて乱れを増加させる影響も外周側12dに比べ遥かに小さい。

【0029】また、図5で示すように、羽根12の外周側12dでは流入気流が集まりほぼ安定した流入流れとなるので、羽根12の入口角の最適化により外周側12dの前縁12aでの流入気流の流入角と前縁12aの設計入口角が大きく異ならないため、羽根12の外周側12dの薄肉の平板形状でも設計の最適化により流れが大きく剥離せず、かつ、羽根12の負圧面側13d近傍の流速が増速されないで、羽根12の吐出側12bの吐出気流が増速されず、吐出気流がファンガード6の線材を通過する際の吐出気流の乱れが大きくなる。

【0030】従って、送風機5の羽根12の負圧面側13c、13dでの大きな剥離による送風騒音の増加とファンガード6から発生する流体騒音の増加の両方を抑える。

【0031】（実施例2）図6～図8は本発明の実施例2の空気調和機等の送風機を示す。尚、実施例1と同一構成の部分については重複をさけるため、同一符号を付けて説明を省略する。

【0032】14は、羽根12の半径方向の略中央から外周側12dの負圧面側13dに設けた複数の略半球形状のディンプルである。

【0033】この構成により、図8で示すように、羽根12の外周側12dに流入気流が集まりほぼ安定した流入流れとなるので、羽根12の入口角の最適化により羽根12の外周側12dの前縁12aでの流入気流の流入角と前縁12aの設計入口角が大きく異ならず、羽根12の外周側12dの薄肉の平板形状でも、羽根12の負圧面側13dにおいて複数のディンプル14の作用により負圧面側13dの表面からの流れの剥離が抑制されるので、流れの乱れが抑えられ、かつ、羽根12の負圧面側13d近傍の流速も羽根12の翼型の断面形状の場合のように増速しないので、羽根12の外周側12dの吐出

気流の流速も増加しない。

【0034】そのため、吐出気流がファンガード6の線材を通過する際の吐出気流の乱れが低減される。従って、送風機5の羽根12の負圧面側13c、13dでの剥離による送風騒音の増加を抑制するとファンガード6から発生する流体騒音が低減する。

【0035】（実施例3）図9～図12は本発明の実施例3の空気調和機等の送風機を示す。尚、実施例1と同一構成の部分については重複をさけるため、同一符号を付けて説明を省略する。

【0036】15は、羽根12の半径方向の略中央から外周側12dの負圧面側13dに設けた複数のリブレット（回転方向に対する縦溝）である。

【0037】この構成により、図12で示すように、羽根12の外周側12dに流入気流が集まりほぼ安定した流入流れとなるので、羽根12の入口角の最適化により羽根12の外周側12dの前縁12aでの流入気流の流入角と前縁12aの設計入口角が大きく異ならず、羽根12の外周側12dの薄肉の平板状の羽根断面形状でも前縁12aの負圧面側13dで流れの剥離が抑制され、さらに、負圧面側13dに設けたリブレット15により、羽根車8の回転の遠心力による羽根12の負圧面側13d近傍の乱流境界層が外周側12dに集積し摩擦抵抗の増大により乱流境界層が発達するのを抑制するので、羽根12が翼型形状の場合のように羽根12の吐出側12bからの吐出気流が増速せず、乱れも抑えられる。

【0038】そのため、吐出気流がファンガード6の線材を通過する際の吐出気流の乱れが低減される。従って、送風機5の羽根12の負圧面側13c、13dでの剥離による送風騒音の増加と羽根12の外周側12dの負圧面側13dでの乱流境界層の発達による送風騒音の増加を抑制すると共に、ファンガード6から発生する流体騒音が低減する。

【0039】

【発明の効果】以上のように本発明によれば、羽根車の回転による遠心力により羽根車内部の気流が羽根の外周側に偏るため、ハブ側では流入角が安定しない不安定な流入流れに対し、羽根前縁に丸みを有する翼型の効果により羽根の負圧面側での大きな剥離を抑え、また、周速も小さいため、翼型化による負圧面側での増速した吐出流れがファンガードにて乱れを増加させる影響も外周側に比べ遥かに小さい。

【0040】また、外周側では、流入気流が集まりほぼ安定した流入流れとなるので、羽根入口角の最適化により薄肉の平板状、あるいは薄肉の翼形状の羽根断面形状でも流れが大きく剥離せず、かつ、羽根負圧面側近傍の流速が増速されないで、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが大きくなる。

【0041】従って、羽根負圧面側での大きな剥離による送風騒音の増加とファンガードから発生する流体騒音

の増加の両方を抑えるという有利な効果が得られる。

【0042】また、外周側において薄肉の平板状、あるいは薄肉の翼形状の羽根断面形状でも羽根負圧面側にてディンプルの作用により負圧面側表面からの流れの剥離が抑制され、流れの乱れが抑えられ、かつ、羽根負圧面側近傍の流速も翼形状のように増速しないので吐出気流がファンガードの線材を通過する際の吐出気流の乱れが低減される。

【0043】従って、羽根負圧面側での剥離による送風騒音の増加を抑制すると共に、ファンガードから発生する流体騒音が低減するという有利な効果が得られる。

【0044】また、羽根外周側において、薄肉の平板状、あるいは薄肉の翼形状の羽根断面形状でも設計の最適化により前縁の負圧面側で流れの剥離が抑制され、さらに、羽根外周部の負圧面側に設けたリブレットにより乱流境界層が発達するのを抑制するので、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが低減される。

【0045】従って、羽根負圧面側での剥離及び乱流境界層の発達による送風騒音の増加を抑制すると共に、ファンガードから発生する流体騒音が低減するという有利な効果が得られる。

【図面の簡単な説明】

【図1】本発明の実施例1における空気調和機等の送風機の断面図

【図2】本発明の実施例1における空気調和機等の送風機の正面図

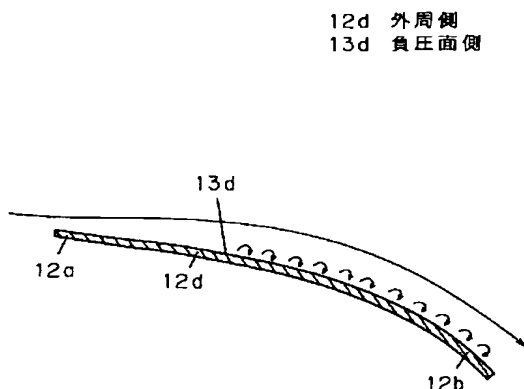
【図3】本発明の実施例1における空気調和機等の送風機のX-X断面図

【図4】本発明の実施例1における空気調和機等の送風機のハブ側(A-A)円筒断面展開図

【図5】本発明の実施例1における空気調和機等の送風機の外周側(B-B)円筒断面展開図

【図6】本発明の実施例2における空気調和機等の送風\*

【図5】



\* 機の正面図

【図7】本発明の実施例2における空気調和機等の送風機のハブ側(A-A)円筒断面展開図

【図8】本発明の実施例2における空気調和機等の送風機の外周側(B-B)円筒断面展開図

【図9】本発明の実施例3における空気調和機等の送風機の正面図

【図10】本発明の実施例3における空気調和機等の送風機のX-X断面図

【図11】本発明の実施例3における空気調和機等の送風機のハブ側(A-A)円筒断面展開図

【図12】本発明の実施例3における空気調和機等の送風機の外周側(B-B)円筒断面展開図

【図13】従来の空気調和機の室外機の断面図

【図14】従来の空気調和機の室外機に用いられる送風機の正面図

【図15】従来の空気調和機の室外送風機のハブ側(A-A)円筒断面展開図

【図16】従来の空気調和機の室外送風機の外周側(B-B)円筒断面展開図

【符号の説明】

5 送風機

6 ファンガード

7 モータ

8 羽根車

8a ハブ

9 オリフィス

12 羽根

12c ハブ側

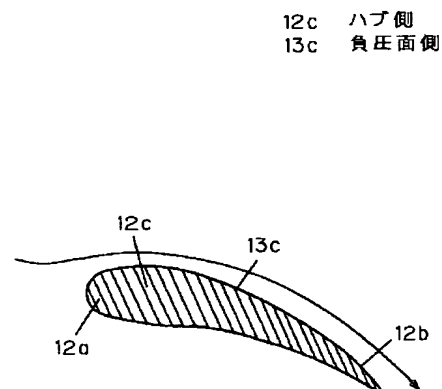
12d 外周側

13c, 13d 負圧面側

14 ディンプル

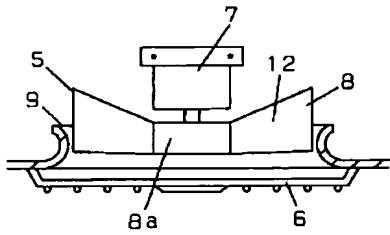
15 リブレット

【図7】



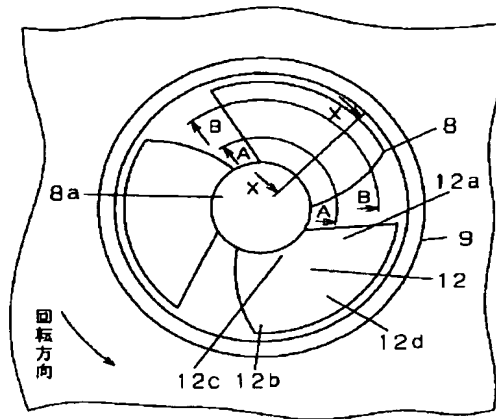
【図1】

- 5 送風機  
6 ファンガード  
7 モータ  
8 羽根車  
8a ハブ  
9 オリフィス  
12 羽根



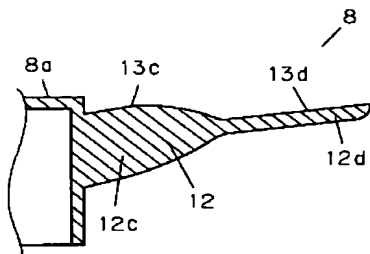
【図2】

- 8 羽根車  
8a ハブ  
9 オリフィス  
12 羽根  
12c ハブ側  
12d 外周側



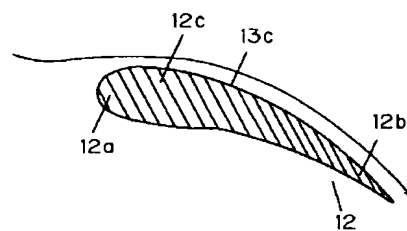
【図3】

- 8 羽根車  
8a ハブ  
12 羽根  
12c ハブ側  
12d 外周側  
13c, 13d 負圧面側

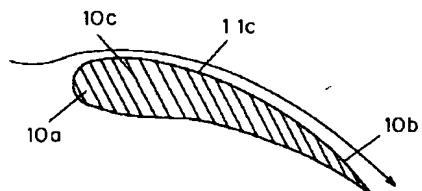


【図4】

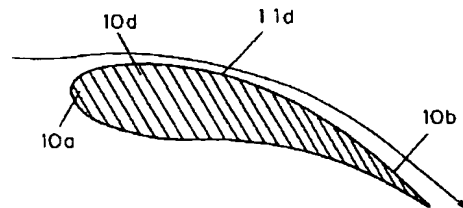
- 12c ハブ側  
13c 負圧面側



【図15】

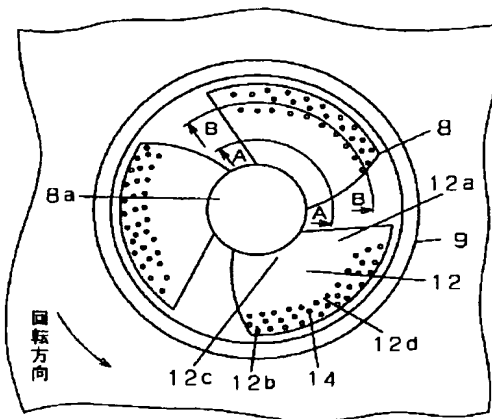


【図16】



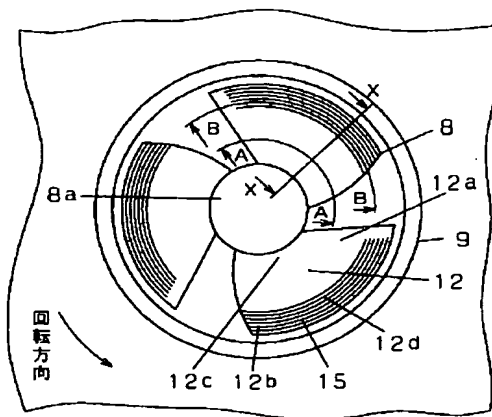
【図6】

- 8 羽根車
- 8a ハブ
- 9 オリフィス
- 12 羽根
- 12c ハブ側
- 12d 外周側
- 14 ディンプル



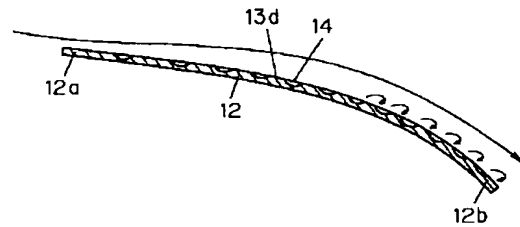
【図9】

- 8 羽根車
- 8a ハブ
- 9 オリフィス
- 12 羽根
- 12c ハブ側
- 12d 外周側
- 15 リブレット



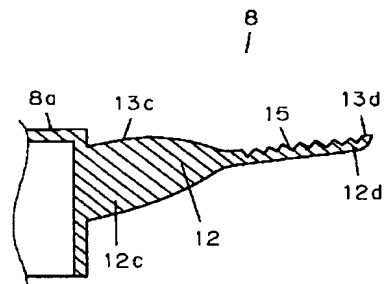
【図8】

- 12d 外周側
- 13d 負圧面側
- 14 ディンプル



【図10】

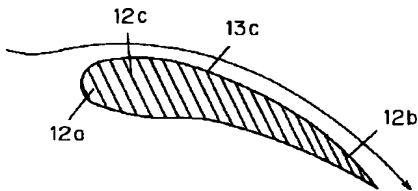
- 8 羽根車
- 8a ハブ
- 12 羽根
- 12c ハブ側
- 12d 外周側
- 13c, 13d 負圧面側
- 15 リブレット





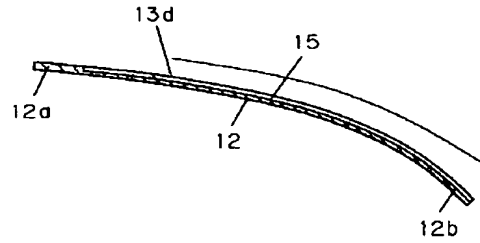
【図11】

12c ハブ側  
13c 負圧面側

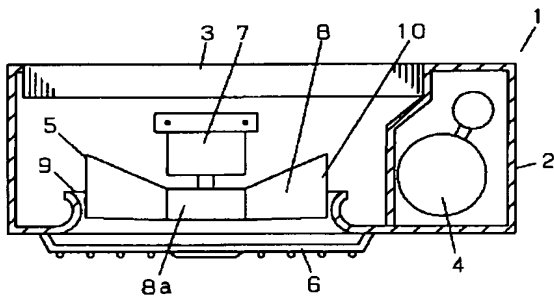


【図12】

12d 外周側  
13d 負圧面側  
15 リブレット



【図13】



【図14】

